

[illegible]

CURRENT DESIGN ACTIVITY CAGE CODE 037Z3
DEFENSE LOGISTICS AGENCY
DLA LAND AND MARITIME,
COLUMBUS, OHIO 43218-3990



Prepared in accordance with ASME Y14.100

Source controlled drawing

Revision Status of Sheets

REV																			
SHEET																			
REV	C	C	C	C	C	C	C	C	C	C	C	C	C						
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13						

PMIC N/A

Original date of drawing

13 February 1991

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TITLE

RECTIFIER, SEMICONDUCTOR DEVICE, ULTRA FAST RECOVERY

DWG NO.

91011

PAGE

1 OF 13

1. SCOPE

1.1 Scope. This drawing describes the requirements for ultra fast recovery rectifiers.

1.2 Part or Identifying Number (PIN). The complete PIN is as follows:

<u>91011</u>	<u>-01</u>	<u>R</u>	<u>TX</u>
Drawing number	Dash number (see 1.2.1)	Polarity indicator (see 1.2.2)	Quality level (see 1.2.3)

1.2.1 Device type. The device types consist of the drawing and dash number that identify the voltage of the devices as follows:

<u>Device type</u>	<u>Voltage</u>
91011-01	200 V dc
91011-02	300 V dc
91011-03	400 V dc

1.2.2 Polarity indicator. A "R" suffix is used to indicate a reverse polarity package version of the device. The "R" suffix indicates polarity is anode to stud.

1.2.3 Quality levels. The "TX" and "TXV" suffixes relate to the JANTX and JANTXV quality levels equivalent in [MIL-PRF-19500](#). The "TX" and "TXV" suffix are included in the PIN.

1.3 Maximum ratings. Unless otherwise specified, $T_C = +25^\circ\text{C}$.

Type	P_T $T_C = +25^\circ\text{C}$	V_{RWM}	I_O at $T_C = +100^\circ\text{C}$	T_{OP} and T_{STG}	I_{FSM} 8.3 ms
	<u>W</u>	<u>V dc</u>	<u>A dc</u>	<u>°C</u>	<u>A (pk)</u>
01	83.3	200	20	-55 to +150	300
02	83.3	300	20	-55 to +150	300
03	83.3	400	20	-55 to +150	300

1.4 Primary electrical characteristics. Unless otherwise specified, primary electrical characteristics at $T_C = +25^\circ\text{C}$.

Type	I_{R1} $V_R = \text{rated } V_{RWM}$	I_{R2} $V_R = \text{rated } V_{RWM}$ $T_A = +125^\circ\text{C}$	V_{FM1} at $I_F = 20 \text{ A}$	V_{FM2} at $I_F = 20 \text{ A}$ $T_C = +125^\circ\text{C}$	t_{rr} Reverse recovery time
	<u>μA</u>	<u>mA</u>	<u>V(pk)</u>	<u>V(pk)</u>	<u>ns</u>
91011-01	50	10	1.25	1.15	50
91011-02	50	10	1.25	1.15	50
91011-03	50	10	1.25	1.15	50

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SIZE

A

CAGE CODE
14933

REV C

DWG NO.
91011

PAGE 2

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.2 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19500 – Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 – Test Methods for Semiconductor Devices.

(Copies of these documents are available online at <https://quicksearch.dla.mil>.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein. All devices described herein shall meet all requirements of MIL-PRF-19500 as specified herein except qualification is not required for these devices. It is prohibited for a manufacturer not listed in 6.5 to mark devices with this drawing number.

3.2 Certification and manufacturer eligibility.

3.2.1 Certification as approved source of supply. In order to be listed as an approved source of supply of rectifiers compliant to this drawing (see 6.5), a manufacturer shall submit a certificate of compliance to DLA Land and Maritime – VAC prior to listing as an approved source of supply. The certificate of compliance shall state that the manufacturer's product meets the screening requirements of MIL-PRF-19500 and the requirements herein.

3.2.2 Manufacturer eligibility. To be eligible for listing as an approved source of supply, a manufacturer shall be either listed on the MIL-PRF-19500 Qualified Manufacturers List for at least one device type or, when specified, perform eligibility inspection in accordance with this drawing (see 4.2) on a sample of parts agreed upon by the manufacturer and DLA Land and Maritime VAC.

3.2.3 Certificate of conformance. A certificate of conformance shall be provided with each shipment of devices delivered in accordance with this drawing to the customer.

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

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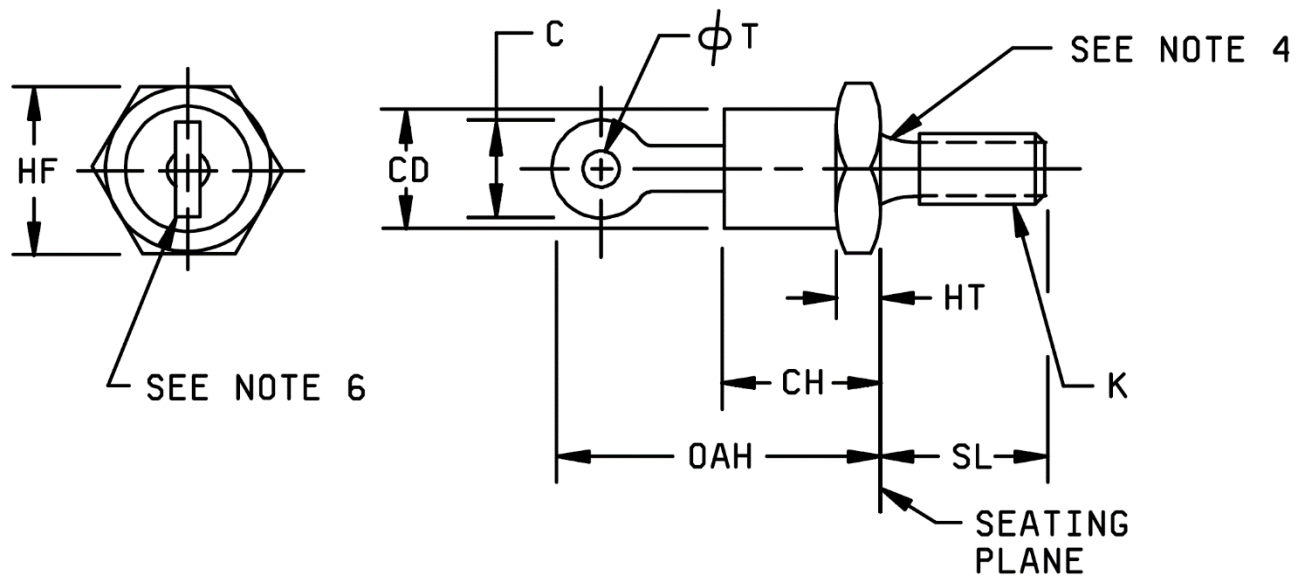
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CAGE CODE
14933

REV C

DWG NO.
91011

PAGE 3



Symbol	Dimensions				Notes
	In		mm		
	Min	Max	Min	Max	
CH		.405		10.29	
CD		.424		10.77	
HF	.424	.437	10.77	11.10	
HT	.075	.175	1.90	4.44	
OAH		.800		20.32	
C		.250		6.35	9
ØT	.060		1.52		
SL	.422	.453	10.72	11.51	
K					3, 5, 7, 8

NOTES:

1. Dimensions are in inches. Metric equivalents are given for general information only.
2. Polarity is cathode to stud, R-suffix polarity is anode to stud.
3. Units must not be damaged by torque of 15 inch-pounds (1.7 Nm) applied to 10-32-UNF-2B nut assembled on thread.
4. Diameter of unthreaded portion .189 inch (4.80 mm) maximum and .163 inch (4.14 mm) minimum.
5. Complete threads to extend to within 2.5 threads of seating plane.
6. Angular orientation of this terminal is undefined.
7. Maximum pitch diameter of plated threads shall be basic pitch diameter .169 inch (4.31 mm).
8. The A.S.A. thread reference is 10-32-UNF-2A.
9. Terminal shape is unrestricted.

FIGURE 1. Physical dimensions of DO-203AA case mount stud package (formerly DO-4).

**DEFENSE ELECTRONICS SUPPLY CENTER
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SIZE

A

**CAGE CODE
14933**

REV C

**DWG NO.
91011**

PAGE 4

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in [MIL-PRF-19500](#). Package shall be a DO-203AA (formerly DO-4) and the dimensions shall be in accordance with [figure 1](#) of this drawing.

3.4.1 Lead material and finish. Lead material shall be copper, copper Kovar or Alloy 52; a copper core or a copper plate is permitted. Lead finish shall be nickel plated and solder dipped. Lead finish shall be solderable in accordance with [MIL-PRF-19500](#), [MIL-STD-750](#), and herein. Where a choice of lead material or finish is desired, it shall be specified in the acquisition document (see [6.2](#)).

3.4.2 Internal construction. Multiple chip construction shall not be permitted.

3.4.3 Terminal connections. The terminal connections shall be in accordance with [figure 1](#).

3.5 Marking. The marking shall be in accordance with [MIL-PRF-19500](#) and herein. All device marking shall appear on the unit package used as the initial packaging for delivery. The following details shall apply:

- a. First line marking: The device PIN see [1.2](#).
- b. Second line marking: Manufacturer's identification or Commercial and Government Entity (CAGE) code.
- c. Third line marking: Lot date code.

3.6 Electrical performance characteristics. The electrical performance characteristics shall be as specified in [1.3](#), [tables I](#) and [II](#).

3.7 Electrical test requirements. The electrical test requirements shall be in accordance with [tables I](#), [II](#), [III](#) and [IV](#) as applicable.

3.8 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.9 Workmanship. The semiconductor device shall be uniform in quality and free from any defects that will affect life, serviceability or appearance.

4. VERIFICATION

4.1 Sampling and inspection. Unless otherwise specified, sampling and inspection procedures shall be performed in accordance with [MIL-PRF-19500](#) and as specified herein.

4.1.1 Inspection of product for delivery. Inspection of product for delivery shall consist of conformance inspection in accordance with [4.4.1](#) and [4.4.2](#) (groups A and B inspection).

4.2 Eligibility verification. When conformance testing is used to verify a device manufacturer eligibility, a sample of devices shall be subjected to inspection of product for delivery in accordance with 4.1.1. When specified, group E inspection shall be performed. In addition, the device manufacturer shall make available to DLA Land and Maritime VAC, upon request, all pertinent test data on its production of the listed parts, including, but not limited to, the results of testing in accordance with [tables I](#), [II](#), [III](#), [IV](#) and [V](#) as applicable.

4.2.1 Group E inspection. Group E inspection shall be performed on test specimens that are representative of subsequent production.

4.2.2 Inspection routines. Group E inspection shall consist of either a full inspection or partial inspection as directed by DLA Land and Maritime VAC.

4.2.2.1 Full inspection. A sample of test specimens shall be submitted for group E inspection and subjected to the testing of each subgroup of [table V](#) in the order shown. Alternately, separate samples of test specimens of the same PIN may be tested for each subgroup. All product characteristics of the PINs to be listed for a manufacturer shall be covered in the full group E inspection.

**DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO**

SIZE

A

CAGE CODE
14933

REV C

DWG NO.
91011

PAGE 5

4.2.2.2 Partial inspection. At the discretion of DLA Land and Maritime VAC, a manufacturer may be required to perform a partial group E inspection for the reasons listed in 4.2.3. The manufacturer shall coordinate with DLA Land and Maritime VAC to determine the applicable subgroups of [table V](#) and sample quantities required to be tested.

4.2.2.3 Extent of listing. A group E inspection on a particular diode PIN shall be extended to cover all other diode PINs of this drawing.

4.2.3 Design, location, material, or process changes. A full or partial group E inspection may be required when any of the following events occurs:

- a. A change in the design affecting form, fit, or function of the part.
- b. A change in the location of the manufacture.
- c. A change in manufacturing source(s), process(es), inspection method(s), tooling or materials, affecting form, fit, or function.
- d. A natural or man-made event, which may adversely affect the manufacturing process.

4.2.4 Nonconformance. The group E inspection is not complete until all non-conformances affecting the part are addressed and corrective actions have been implemented and accepted. The group E inspection shall be repeated for the affected characteristics and the results recorded.

4.3 Screening. All devices shall be screened in accordance with table E-IV of [MIL-PRF-19500](#) and as specified herein. The following measurements shall be made in accordance with [table I](#) herein. Devices that exceed the limits of [table I](#) herein shall not be acceptable.

Screen	Measurements for TX and TXV levels
3c (1)	Thermal response (see 4.5.3)
10	Not applicable
11	Not applicable
12	Method 1038 of MIL-STD-750, test condition A, 96 hours min, T _A = 125°C, V = rated V _{RWM}
13	Not applicable

(1) Shall be performed anytime before screen 10.

4.4 Conformance inspections. Conformance inspection shall be in accordance with [MIL-PRF-19500](#) and consist of the examinations and tests specified in [tables I, II](#) and [III](#).

4.4.1 Group A inspection. Group A inspection shall consist of the inspections and tests specified in [table I](#).

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing of table E-IVB in [MIL-PRF-19500](#) and [table II](#) herein. Electrical measurements shall be in accordance with [table IV](#) herein.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions for subgroup testing in table E-V of [MIL-PRF-19500](#), and [table III](#) herein. Electrical measurements (end points) shall be in accordance with the applicable steps of [table IV](#) herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of [MIL-STD-750](#).

**DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO**

SIZE

A

CAGE CODE
14933

REV C

DWG NO.
91011

PAGE 6

4.5.2 Thermal resistance. Thermal resistance measurements shall be performed in accordance with method 3101 or 4081 of MIL-STD-750. The maximum limit of $R_{\theta JC(max)}$ shall be 1.5°C/W.

4.5.3 Thermal response (ΔV_F measurements). The ΔV_F measurements shall be performed in accordance with method 3101 of MIL-STD-750. The ΔV_F conditions and maximum V_F limit shall be derived by each vendor. The chosen V_F measurements and conditions for each device in the qualification lot shall be submitted in the qualification report and a thermal response curve shall be plotted. The chosen V_F value shall be considered final after the manufacturer has had the opportunity to test five consecutive lots.

4.5.4 Reverse recovery time. The reverse recovery time characteristics shall be determined in accordance with method 4031 of MIL-STD-750. The reverse recovery time shall be measured as specified in the circuit of figure 2 or equivalent. Care should be exercised to minimize stray inductance in the test circuit and to insure that the total resistance of the reverse current loop can be adjusted sufficiently low so that more than one ampere will flow if not blocked by the diode being tested. Switch SW shall be activated and the regulated voltage source adjusted to achieve the specified forward current when SW is open. The reverse recovery time shall be determined from the current waveform as shown on figure 3 or equivalent.

TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit	Limit	Unit
	Method	Condition		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Reverse current	4016	Condition A or B, $V_R = \text{rated } V_{RWM}$	I_{R1}		50	$\mu\text{A dc}$
Forward current	4011	Condition A, B or C; $I_F = 20 \text{ A (pk)}$	V_{F1}		1.25	V (pk)
<u>Subgroup 3</u>						
High temperature operation		$T_A = 125^\circ\text{C}$				
Reverse current	4016	Condition A or B, $V_R = \text{rated } V_{RWM}$	I_{R2}		10	mA dc
Forward current	4011	Condition A, B or C; $I_F = 20 \text{ A (pk)}$	V_{F2}		1.15	V (pk)
<u>Subgroup 4</u>						
Reverse recovery time	4031	$T_A = 25^\circ\text{C}$, $I_F = 0.5 \text{ A}$, $I_R = 1 \text{ A}$, $I_{REC} = 0.25 \text{ A}$, see 4.5.4.	t_{rr}		50	ns
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Surge current	4066	Condition A, $T_P = 8.3 \text{ ms}$, $I_O = 0$, $I_{FSM} = 300 \text{ A}$, 6 surges minimum. 1 surge per minute, maximum				
Electrical measurements		See table IV, steps 1 and 2				

1/ For sampling plan, see MIL-PRF-19500.

**DEFENSE ELECTRONICS SUPPLY CENTER
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SIZE

A

**CAGE CODE
14933**

REV C

**DWG NO.
91011**

PAGE 7

TABLE II. Group B inspection.

Inspections	MIL-STD-750	
	Method	Condition
<u>Subgroup 1</u> ^{1/}		
Solderability	2026	
Resistance to solvents	1022	
<u>Subgroup 2</u>		
Thermal shock (temperature cycling)	1051	T _{Low} = -55°C T _{high} = 150°C
Hermetic seal	1071	Fine and gross leak
Electrical measurements		Table IV , steps 1 and 2
<u>Subgroup 3</u>		
Steady state blocking	1038	Condition A, T _A = 125°C, I _O = 0, f = 60 Hz, V _R = rated V _{RWM} or dc, V _R = 85 percent rated V _{RWM}
Electrical measurements		Table IV , steps 1 and 2
<u>Subgroup 4</u>		
Decap internal visual (design verification)	2075	See 3.4.2
<u>Subgroup 5</u>		
Thermal resistance	3010 or 4081	See 4.5.2
<u>Subgroup 6</u>		T _A = 150°C
High temperature (nonoperating)	1032	
Electrical measurements		Table IV , steps 1 and 2

^{1/} For sampling plan, see [MIL-PRF-19500](#).

TABLE III. Group C inspection.

Inspection 1/	MIL-STD-750	
	Method	Condition
<u>Subgroup 1</u>		
Physical dimensions	2066	See 3.4 and figure 1
<u>Subgroup 2</u>		
Thermal shock (glass strain)	1056	Condition B
Thermal shock (tension)	2036	Test condition A; weight = 5 pounds (2.27 Kg); t = 15 s
Hermetic seal	1071	Fine and gross leak
Moisture resistance	1021	Omit initial conditioning
Visual and mechanical examination	2071	
Electrical measurements		Table IV , steps 1 and 2
<u>Subgroup 3</u>		
Not applicable		
<u>Subgroup 4</u>		
Salt atmosphere (corrosion)	1041	
<u>Subgroup 5</u>		
Not applicable		
<u>Subgroup 6</u>		
Steady state blocking	1038	Condition A, $T_A = 125^{\circ}\text{C}$, $I_O = 0$, $f = 60\text{ Hz}$, $V_R = \text{rated } V_{RWM} \text{ or dc}$, $V_R = 85\text{ percent rated } V_{RWM}$
Hermetic seal	1071	Fine and gross leak
Electrical measurements		Table IV , steps 1 and 2

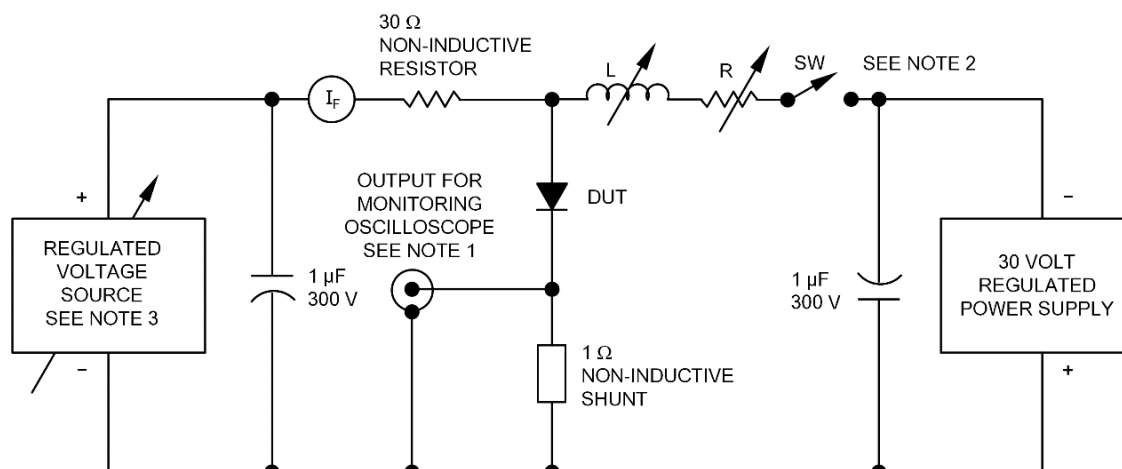
1/ For sampling plan, see [MIL-PRF-19500](#).

TABLE IV. Groups A, B and C end-point measurements.

Step	Inspection	MIL-STD-750		Symbol	Limit	Limit	Unit
		Method	Conditions		Min	Max	
1	Reverse current	4016	$V_R = \text{rated } V_{RWM}$	I_{R1}		50	$\mu\text{A dc}$
2	Forward voltage	4011	Condition A, B or C; $I_F = 20 \text{ A (pk)}$	V_{F1}		1.25	V (pk)
3	Reverse current	4016	Condition A or B	ΔI_{R1}	$\pm 100\%$ of initial value or 2.5 μA whichever is greater		

TABLE V. Group E inspection.

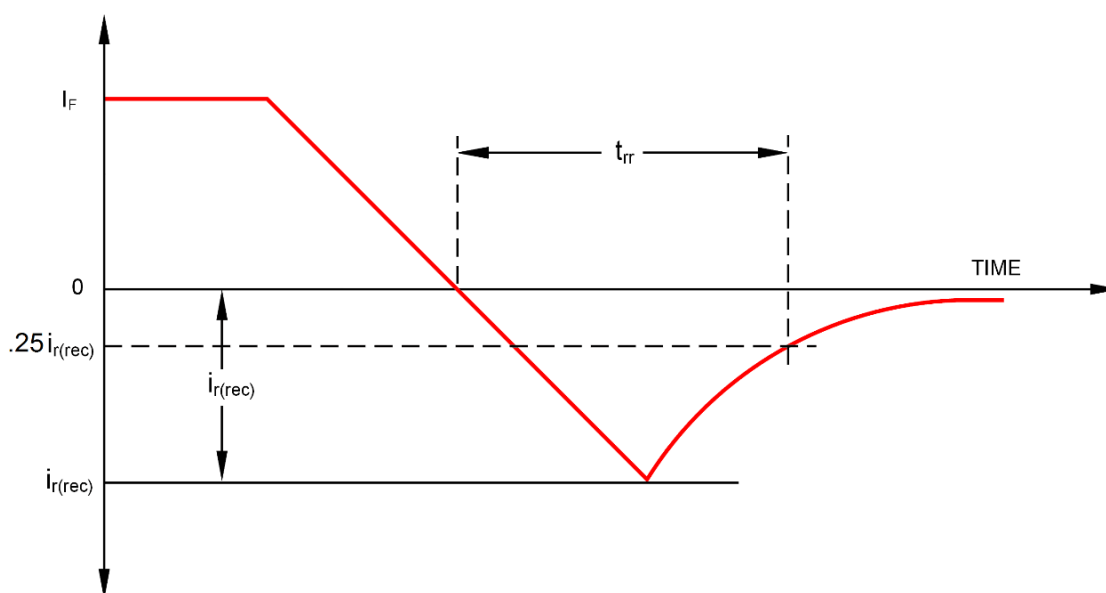
Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices, c = 0
Temperature cycling	1051	500 cycles, condition C, -55°C to +175°C.	
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 2</u>			45 devices, c = 0
Life test	4066	1,000 hours.	
Electrical measurements		See table I , subgroup 2.	
<u>Subgroups 4, 5, and 6</u>			
Not applicable			
<u>Subgroup 10</u>			
Surge current	4066	Condition A, 100 surges of 8.3 ms superimposed on I_O . $V_R = 0$; $I_O = 0 \text{ A pk}$ half sine wave, continuous, $T_A = +25^\circ\text{C}$.	
Electrical measurements		See table I , subgroup 2.	



NOTES:

1. Monitoring oscilloscope requirements: $T_r \leq 14 \text{ ns}$, $R_{in} \geq 9 \text{ M}\Omega$, $C_{in} \leq 12 \text{ pF}$, $L_{in} \text{ (series)} \leq 0.5 \mu\text{H}$.
2. SW characteristics: Mercury-wetted make-before-break relay switches at a 60 Hz rated. The relay should conduct for approximately 7.7 ms. (C.P. Clare HGP 1004 or equivalent). Pulse generator may be used to satisfy input requirements.
3. Voltage source characteristics: Output impedance $\leq 0.5 \Omega$ from 0 to 2 kHz.

FIGURE 2. Reverse recovery test circuit.



NOTE: Inductor L and resistor R of figure 2 shall be adjusted to achieve the specified di/dt .

FIGURE 3. Reverse recovery current waveform through device under test.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's system command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. Devices conforming to this drawing are intended for use when performance specifications do not exist and qualified performance devices that will perform the required function are not available for OEM application. This drawing is intended exclusively to prevent the proliferation of duplicate specifications, drawings, and stock number listings. When a performance specification is created and the product covered by this drawing has been listed on [QPDSIS-19500](#), this drawing will be superseded by the [QPDSIS-19500](#) product and shall be preferred item for all applications.

6.2 Acquisition requirements. The acquisition requirements should specify the following:

- a. Complete PIN (see [1.2](#)).
- b. Title, number, and date of this specification.
- c. Requirements for delivery of one copy of the conformance inspection data or certificate of compliance that parts have passed conformance inspection with each shipment of parts by the manufacturer.
- d. Requirements for packaging and packing.
- e. Lead finish may be specified (see [3.4.1](#)).
- f. The value for di/dt needed for reverse recovery characteristics.

6.3 Users of record. Coordination of this document for future revisions are coordinated only with the suggested sources of supply and the users of record of this document. Requests to be added as a recorded user of this drawing should be in writing to: DLA Land and Maritime, ATTN: VAC, Post Office Box 3990, Columbus, OH 43216-5000 or by e-mail to: semiconductor@dla.mil.

6.4 Replaceability. Devices covered by this drawing may be used to replace the same generic devices covered by a contractor-prepared specification or drawing.

DESC drawing PIN	Vendor similar designation or type number ^{1/} CAGE: 11961	Vendor similar designation or type number ^{1/} CAGE: 12969
91011-01TX, TXV	S5309	UES704HR
91011-01TX, TXV	S5310	UTG5468
91011-01TX, TXV	S5311	UES706HR

^{1/} CAUTION: Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

**DEFENSE ELECTRONICS SUPPLY CENTER
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SIZE

A

CAGE CODE
14933

REV C

DWG NO.
91011

PAGE 12

6.5 Approved sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. The vendors listed herein have agreed with this drawing and have submitted a certificate of compliance (see 3.2.1 herein) to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990 or emailed to semiconductor@dla.mil.

DESC drawing PIN (1)	Vendor similar designation or type number (2)	Vendor CAGE	Vendor name and address
91011-01TX, TXV 91011-01RTX, TXV 91011-02TX, TXV 91011-02RTX, TXV 91011-03TX, TXV 91011-03RTX, TXV	UFR3120 UFR3120R UFR3130 UFR3130R UFR3140 UFR3140R	43611	Microsemi Lawrence 6 Lake Street Lawrence, MA 01841 Tele: (978) 620-2600 FAX: (978) 689-0803 E-mail: support@mircosemi.com URL: http://www.microsemi.com

- (1) Parts must be purchased to this DESC PIN to assure that all performance requirements and tests are met.
(2) CAUTION: Do not use vendor PIN's for acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

6.6 Comments. Comments on this drawing should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to semiconductor@dla.mil.

**DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO**

SIZE

A

CAGE CODE
14933

REV C

DWG NO.
91011

PAGE 13